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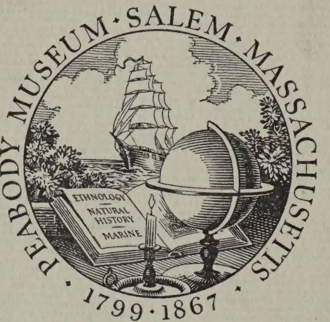

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THE METHOD

OF

FINDING THE LONGITUDE,

AT SUNRISE AND SUNSET.

AND, ALSO,

AT NOON.

PEABODY MUSEUM OF SALEM

FROM WILLIAM LEAVITT'S NAUTICAL ACADEMY.

SALEM:
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ADVERTISEMENT.

It frequently happens that the Sun is visible for a few minutes after rising, or before setting, though obscured for the remainder of the day ; and it would be a most important resource to the navigator, if by obtaining the true time at either of those moments, he could ascertain his longitude by Chronometer.

It is true, that the extreme variableness of refraction, so near the horizon, must render this method only an approximation to the truth, yet as the limits of error, from that source, can scarcely amount to half a minute of time, and as the knowledge of the ship's place in the morning, after a long night's run, or before shaping the course at nightfall would be very valuable, it is to be desired, that this method of observation should be adopted generally by seamen.

Tables I. and II. show the altitudes of the upper and lower limbs of the Sun, at the moment that its centre crosses the true horizon. They are to be entered with the semi-diameter of the Sun at the top of the page, and the height of the observer's eye at the side column, and the altitude corresponding to these two arguments is to be placed on the limb of the sextant, after being inversely corrected for the index error.

With this altitude the observer is to watch the rising or falling of whichever limb he has chosen, and to note by his Chronometer the instant that it touches the horizon of the sea : the upper limb should generally be preferred, but, in order to render the observation more secure, it would be prudent to be prepared with a second sextant for the lower limb, or that two observers be employed.

The instant that the limb which you have chosen touches the horizon of the sea, then the altitude of the Sun's centre is nothing or 0° 00′ and the time is worked out in the usual manner, and the half sum of the four logarithms is sought for, as usual, in the column of sines either at the top or bottom of the page, and when found at the bottom, be sure and take the letters A. M., and P. M., at the bottom also.

EXAMPLE I.

October 14*th*, 1847—*At Sunrise.*

Lat. by account,	15d 46m N.
Long. " "	70d 10m E.
Sun's declination corrected,	4d 02m 17s S.
Sun's semi-diameter,	16m 01s
Index error of sextant,	+ 1m 10s
Equation of time,	—10m 59s
Height of the eye,	15 feet.

With the above data, the altitude of the Sun's upper limb will be found in table I. to be 46m 26s. The sextant having been set to that angle (—1m 10s index error,) the Sun's upper limb was observed to touch the horizon at 12h 44m 17s by a Chonometer which was slow of Greenwich, mean-time 0h 29m 01s.

	D.	M.		
Sun's alt.	0	00		
Ship's lat.	15	46	Secant,	0.01666
Sun's P. D.	94	02	Cosecant,	0.00108
Sum,	109	48		
Half sum,	54	54	Cosine,	9.75967
Sun's alt.	0	00		
Remainder,	54	54	Sine,	9.91283

	H.	M.	S.		
				Sum,	19.69024
	6	04	34	Half sum,	9.84512
Equation		—10	59		
Mean-time,	5	53	35		
Add,	12	00	00		
Ship's time,	17	53	35		

	H.	M.	S.
Chro. time,	12	44	17
Add,		29	01
[Greenwich M. T.	13	13	18

	H.	M.	S.
Ship's time,	17	53	35
Greenwich M. T.	13	13	18
Long. in time,	4	40	17

Equal to 70d 04m 15s East.

EXAMPLE II.

December 8th, 1847—At Sunset.

Latitude,	6d 46m S.
Longitude,	24d 10m W.
Sun's declination,	22d 44m S.
Sun's S. D.	16m 16s
Index error,	— 50s
Equation,	— 7m 53s
Height of eye,	15 feet.

With the Sun's S. D. 16m 16s and the height of eye 15 feet, the altitude of the Sun's lower limb is found to be 18m 10s.

Altitude Sun's L. L. 18m 10s
Index error, add 50s

Gives, 19m 00s which is to be placed on the sextant, with this altitude the Sun's L. L. touched the horizon at 7h 12m 32s by Chronometer which was slow of Greenwich mean-time, 25m 22s

Chro.	7h 12m 32s
Add,	25m 22s
True Greenwich time,	7h 37m 54s

		D.	M.		
Sun's alt.		0	00		
Lat.		6	46	Secant,	0.00304
Sun's P. D.		67	16	Cosecant,	0.03512
Sum,		74	02		
Half sum,		37	01	Cosine,	9.90225
Sun's alt.		0	00		
Remainder,		37	01	Sine,	9.77963
	H.	M.	S.	Sum,	19,72004
	6	11	24	Half sum,	9.86002
Equation,		— 7	53		
Mean-time at the ship,	6	03	31		

	H.	M.	S.
Chro. time,	7	37	54
Ship's time,	6	03	31
Long. in time,	1	34	23

Long. 23d 35m 45s W.

TABLE 1.—ALTITUDE OF THE SUN'S UPPER LIMB.

Height of eye in feet.	SUN'S SEMI-DIAMETER.						
	M. S. 15 45	M. S. 15 50	M. S. 15 55	M. S. 16 00	M. S. 16 05	M. S. 16 10	M. S. 16 15
5	44 35	44 40	44 45	44 45	44 50	44 55	45 00
6	44 50	44 50	44 55	45 00	45 05	45 10	45 15
7	45 00	45 05	45 05	45 10	45 15	45 20	45 25
8	45 10	45 15	45 20	45 25	45 25	45 30	45 35
9	45 20	45 25	45 30	45 30	45 35	45 40	45 45
10	45 30	45 35	45 40	45 40	45 45	45 50	45 55
11	45 35	45 40	45 45	45 50	45 55	46 00	46 05
12	45 45	45 50	45 55	46 00	46 05	45 10	46 15
13	45 55	46 00	46 05	46 10	46 15	46 15	46 20
14	46 05	46 10	46 10	46 15	46 20	46 25	46 30
15	46 10	46 15	46 20	46 25	46 30	46 30	46 35
16	46 20	46 25	46 30	46 30	46 35	46 40	46 45
17	46 25	46 30	46 35	46 40	46 45	46 50	46 55
18	46 35	46 40	46 45	46 50	46 50	46 55	47 00
19	46 40	46 45	46 50	46 55	47 00	47 05	47 05
20	46 50	46 50	46 55	47 00	47 05	47 10	47 15
21	46 55	47 00	47 05	47 05	47 10	47 15	47 20
22	47 00	47 05	47 10	47 15	47 20	47 20	47 25
23	47 05	47 10	47 15	47 20	47 25	47 30	47 30
24	47 10	47 15	47 20	47 25	47 30	47 35	47 40
25	47 20	47 20	47 25	47 30	47 35	47 40	47 45
26	47 25	47 25	47 30	47 35	47 40	47 45	47 50
28	47 35	47 40	47 45	47 50	47 55	48 00	48 00
30	47 45	47 50	47 55	48 00	48 05	48 10	48 15
32	47 55	48 00	48 05	48 10	48 15	48 20	48 25
34	48 05	48 10	48 15	48 20	48 25	48 30	48 30
36	48 15	48 20	48 25	48 30	48 35	48 40	48 40
38	48 25	48 30	48 35	48 40	48 45	48 50	48 50
40	48 35	48 40	48 45	48 50	48 55	49 00	49 00
42	48 45	48 50	48 55	49 00	49 00	49 05	49 10
44	48 55	49 00	49 00	49 05	49 10	49 15	49 20
46	49 05	49 05	49 10	49 15	49 20	49 25	49 30
48	49 10	49 15	49 20	49 25	49 30	49 30	49 35
50	49 20	49 25	49 25	49 30	49 35	49 40	49 45
55	49 35	49 40	49 45	49 50	49 55	50 00	50 05
60	49 55	50 00	50 05	50 10	50 10	50 15	50 20
65	50 10	50 15	50 20	50 25	50 30	50 35	50 40

TABLE II.—ALTITUDE OF THE SUN'S LOWER LIMB.

Height of eye in feet.	SUN'S SEMI-DIAMETER.						
	M. S. 15 45	M. S. 15 50	M. S. 15 55	M. S. 16 00	M. S. 16 05	M. S. 16 10	M. S. 16 15
5	17 00	16 55	16 50	16 45	16 40	16 40	16 35
6	17 15	17 10	17 05	17 00	16 55	16 50	16 45
7	17 25	17 20	17 15	17 10	17 05	17 00	16 55
8	17 35	17 30	17 25	17 20	17 15	17 15	17 10
9	17 45	17 40	17 35	17 30	17 25	17 25	17 20
10	17 55	17 50	17 45	17 40	17 35	17 30	17 25
11	18 05	18 00	17 55	17 50	17 45	17 40	17 35
12	18 15	18 10	18 05	18 00	17 55	17 50	17 45
13	18 20	18 15	18 10	18 05	18 05	18 00	17 55
14	18 30	18 25	18 20	18 15	18 10	18 05	18 00
15	18 35	18 30	18 25	18 20	18 20	18 15	18 10
16	18 45	18 40	18 35	18 30	18 25	18 20	18 20
17	18 50	18 45	18 45	18 40	18 35	18 30	18 25
18	19 00	18 55	18 50	18 45	18 40	18 35	18 35
19	19 05	19 00	18 55	18 50	18 50	18 45	18 40
20	19 15	19 10	19 05	19 00	18 55	18 50	18 45
21	19 20	19 15	19 10	19 05	19 00	18 55	18 50
22	19 25	19 20	19 15	19 10	19 05	19 05	19 00
23	19 30	19 25	19 20	19 15	19 15	19 10	19 05
24	19 40	19 35	19 30	19 25	19 20	19 15	19 10
25	19 45	19 40	19 35	19 30	19 25	19 20	19 15
26	19 50	19 45	19 40	19 35	19 30	19 25	19 20
28	20 00	19 55	19 50	19 45	19 45	19 40	19 35
30	20 10	20 05	20 05	20 00	19 55	19 50	19 45
32	20 20	20 15	20 15	20 10	20 05	20 00	19 55
34	20 30	20 25	20 20	20 20	20 15	20 10	20 05
36	20 40	20 35	20 30	20 25	20 25	20 20	20 15
38	20 50	20 45	20 40	20 35	20 35	20 30	20 25
40	21 00	20 55	20 50	20 45	20 45	20 40	20 35
42	21 10	21 05	21 00	20 55	20 50	20 45	20 45
44	21 20	21 15	21 10	21 05	21 00	20 55	20 50
46	21 30	21 25	21 20	21 15	21 10	21 05	21 00
48	21 35	21 30	21 25	21 20	21 20	21 15	21 10
50	21 45	21 40	21 35	21 30	21 25	21 20	21 15
55	22 00	21 55	21 50	21 50	21 45	21 40	21 35
60	22 20	22 15	22 10	22 05	22 00	21 55	21 55
65	22 40	22 35	22 30	22 25	22 20	22 15	22 10

LONGITUDE AT NOON.

The method of finding the longitude by Chronometer, at noon, by equal altitudes.

About ten or fifteen minutes before noon, observe the altitude of the Sun, and note the time by Chronometer. After noon, observe when the Sun falls to the same altitude and note the time by Chronometer, add these two Chronometer times together, and take the half sum, to this half sum apply the error of the Chronometer, and reduce it to apparent time by subtracting the equation if it has been added, or adding it if it has been subtracted. The remainder is the longitude in time.

EXAMPLE I.

At Sea, August 26, 1845.

	D.	M.		H.	M.	S.
The Sun's altitude A. M. was	60	02.	The time by Chro.	4	22	17
" " " P. M. "	60	02.	" " " "	5	38	36
			Sum,	10	00	53
			Half sum,	5	00	26
			Chronometer too fast,			04
				5	00	22
The equation by the N. A. being additive, is now to be subtracted,					1	36
			Long. in time,	4	58	46

EXAMPLE II.

At Sea, December 9, 1846.

	D.	M.	S.		H.	M.	S.
The Sun's altitude A. M., was	54	42	15.	Time by Chro.	2	41	20
" " " P. M., "	54	42	15.		3	14	14
				Sum,	5	55	34
				Half sum,	2	57	47
						6	43
				Long. in time,	2	51	04

	M.	S.
Chronometer too fast,	14	04
Equation N. A. subtractive is to be added,	7	21
Difference to be subtracted,	6	43

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